



US009230705B2

(12) **United States Patent**
Ryu et al.

(10) **Patent No.:** **US 9,230,705 B2**
(45) **Date of Patent:** **Jan. 5, 2016**

(54) **PORTABLE LATENT FINGERPRINT
DEVELOPING APPARATUS**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 559 days.

(21) Appl. No.: **13/707,686**

(22) Filed: **Dec. 7, 2012**

(65) **Prior Publication Data**

US 2014/0085444 A1 Mar. 27, 2014

(30) **Foreign Application Priority Data**

Sep. 26, 2012 (KR) 10-2012-0107031

(51) **Int. Cl.**
G21K 5/08 (2006.01)
H04N 5/222 (2006.01)
G06K 9/00 (2006.01)
A61B 5/117 (2006.01)

(52) **U.S. Cl.**
CPC **G21K 5/08** (2013.01); **G06K 9/00013**
(2013.01); **H04N 5/222** (2013.01); **A61B**
5/1172 (2013.01)

(58) **Field of Classification Search**

CPC A61B 5/1172; A61B 5/117; B44F 1/10;
G03F 1/68; G03F 1/0038; G21K 5/00; G21K
5/08; G06K 9/00013; C23C 14/246; B05C
5/02

USPC 118/31.5, 715, 726; 427/1, 145;
250/492.1; 430/10

See application file for complete search history.

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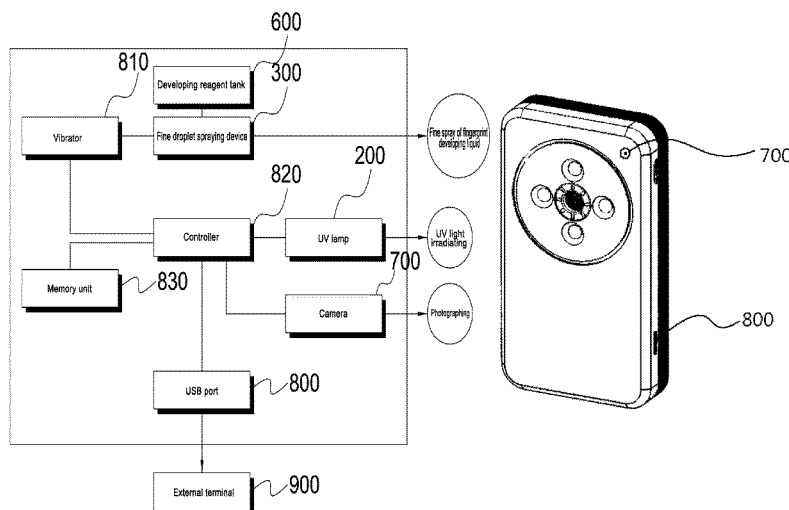
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(57) **ABSTRACT**

Disclosed is a portable latent fingerprint developing apparatus capable of visibly checking out an external shape of a finger print by using an UV LED lamp, after a fine spray of a fingerprint developing liquid is conducted by using a vibrator and providing the corresponding fingerprint image to an external terminal, after it is photographed by a camera.

16 Claims, 8 Drawing Sheets



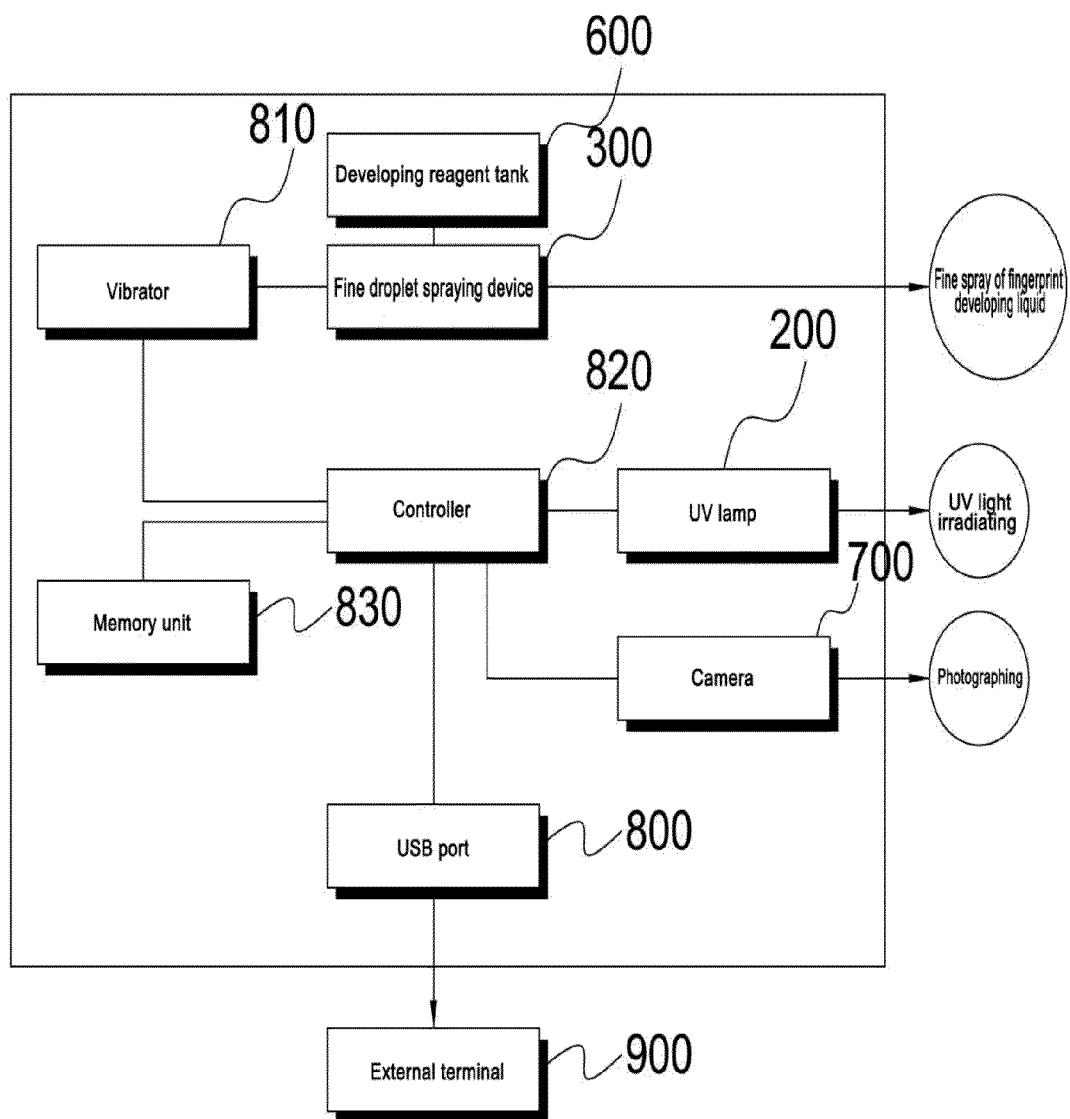


FIG. 1



FIG. 2

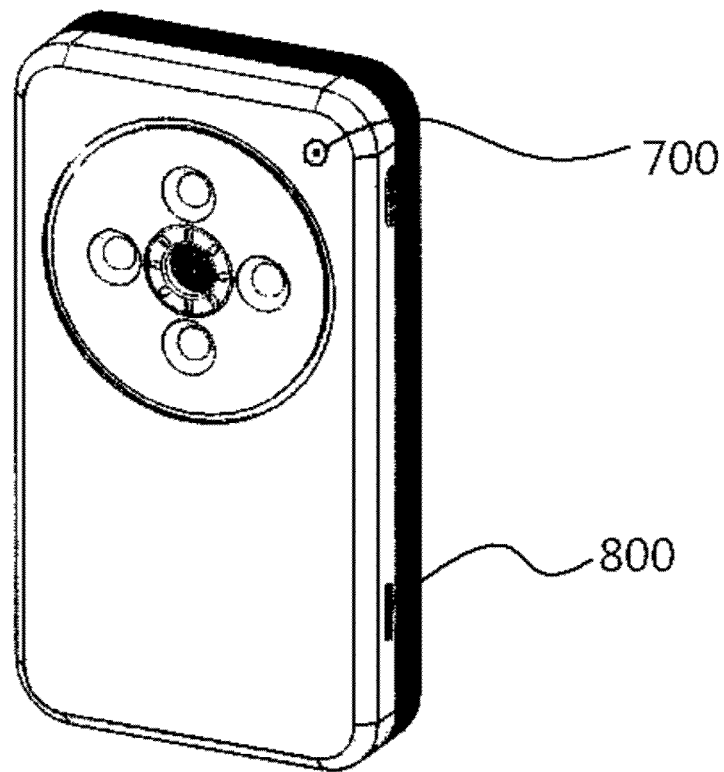
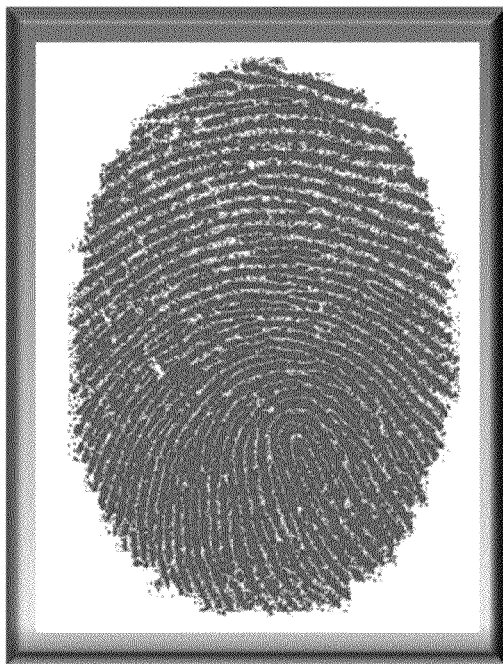


FIG. 3

Effect of fingerprint developing

Conventional art



Present invention

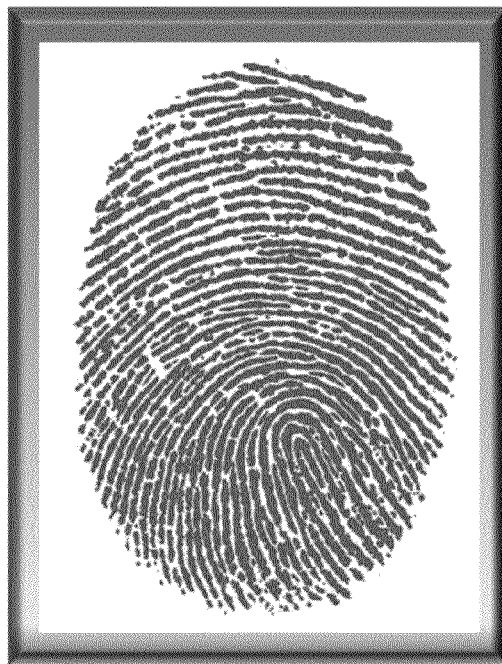


FIG. 4

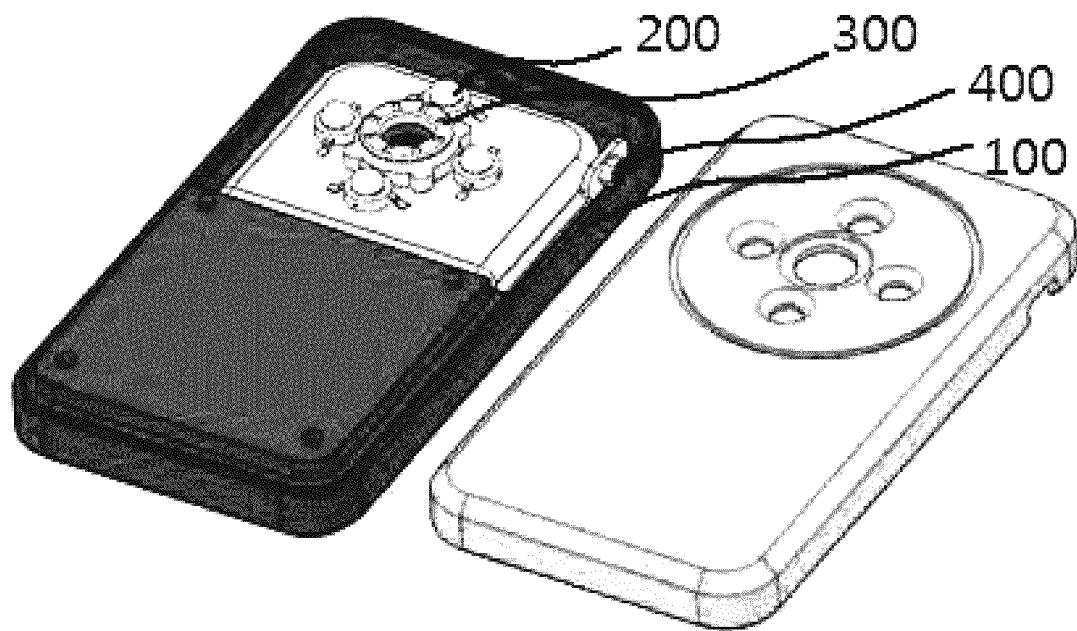


FIG. 5

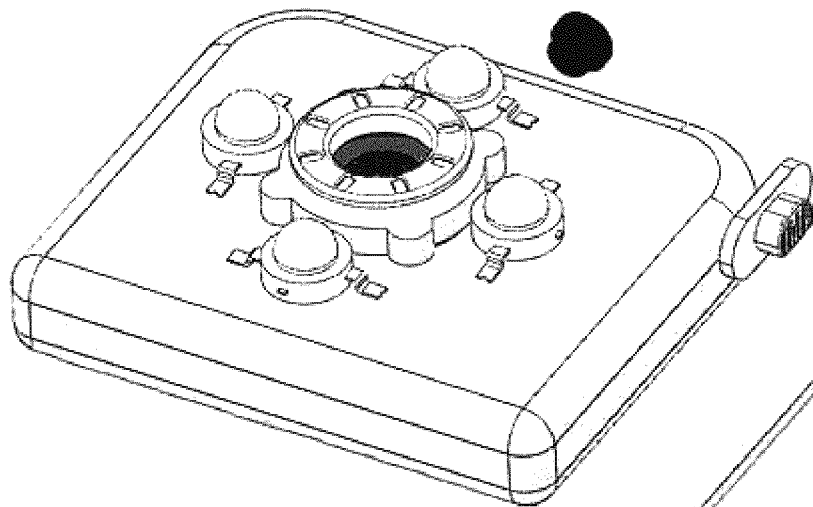


FIG. 6



FIG. 7

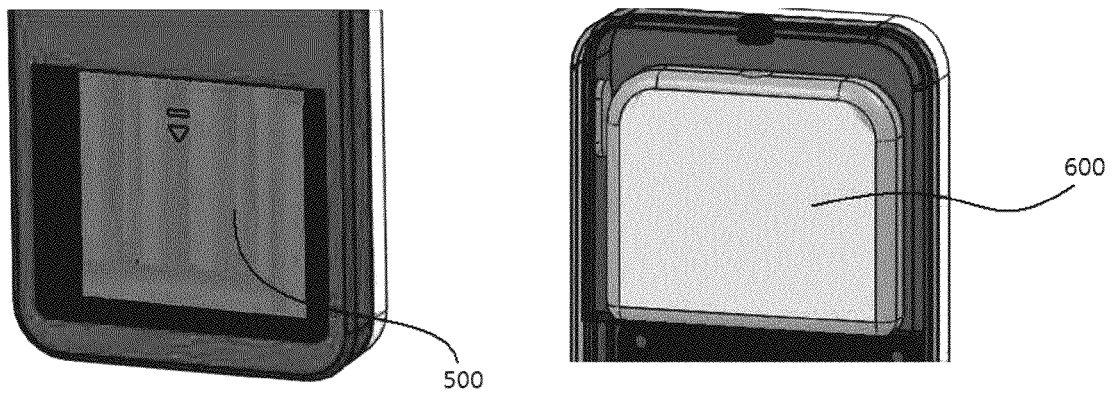


FIG. 8

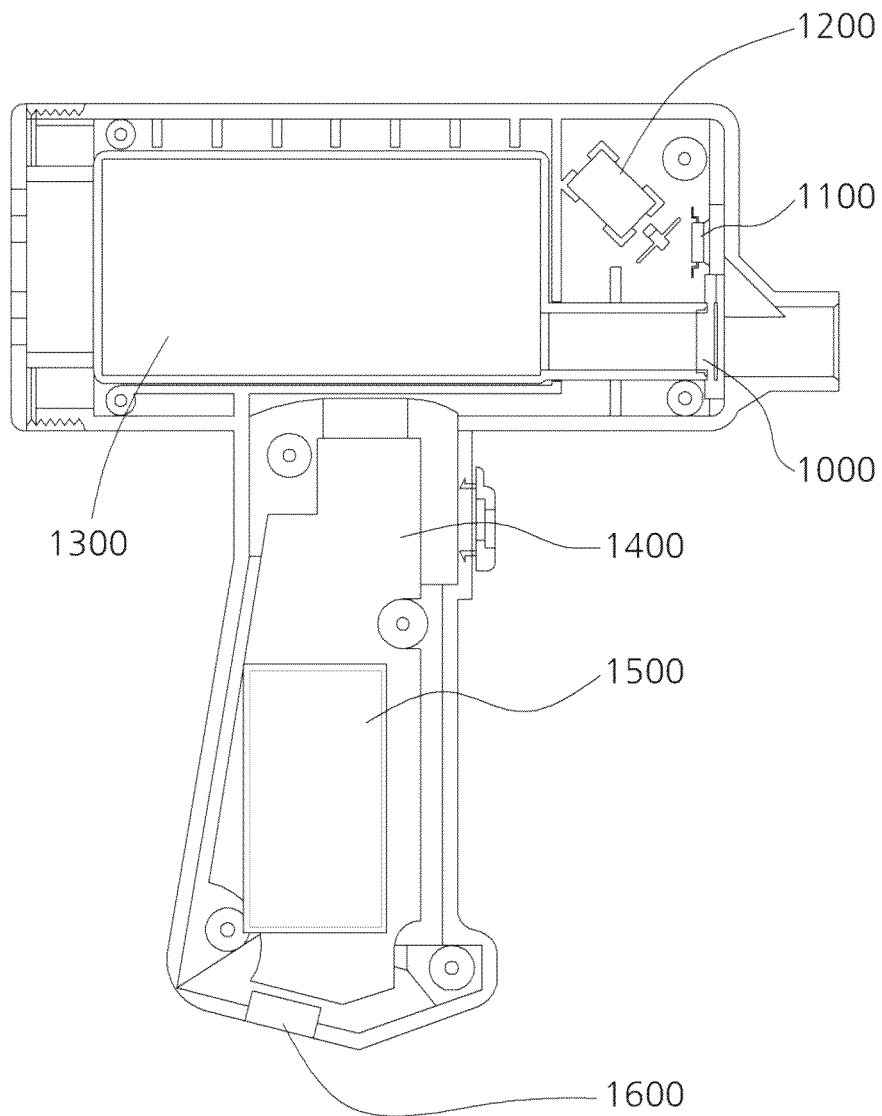


FIG. 9

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PORTABLE LATENT FINGERPRINT DEVELOPING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a portable latent fingerprint developing apparatus. More particularly, the present invention relates to a portable latent fingerprint developing apparatus capable of visibly checking out an external shape of a finger print by using an UV LED lamp, after a fine spray of a fingerprint developing liquid is conducted by using a vibrator and providing the corresponding fingerprint image to an external terminal, after it is photographed by a camera.

2. Description of the Prior Art

According to the supply the state-of-the-art digital equipment such as a color printer or a scanner etc., the counterfeit money has been rapidly increased all over the world.

Also, since the counterfeit money discrimination device, which is used all over the world, is very expensive and it is uncomfortable to use, there is a limit on the supply thereof.

In the meantime, according to data from the Bank of Korea, when 50,000 won large bills were issued in 2009, the probability of the counterfeit thereof is increased by the counterfeiters.

With the development of the office automation equipment, which is a computer peripheral equipment, various digital color output equipment (copy machine or printer) having superior resolution (400 dpi to 1,440 dpi) have been appeared. Accordingly, since banks and securities can be easily copied, various crimes such as the counterfeit thereof etc. have been increased.

In order to solve these problems, the anti-forgery techniques of the bills are studied. In the anti-forgery techniques, there are a silver coin, a silver wire, a fluorescent color fiber, an optically variable printing material, an intaglio printing, a fluorescent ink, an intaglio latent image, a fine lettering, and a line printing etc.

In the counterfeit discernment method of the techniques for counterfeit prevention applied to the banks and the securities, if it shines the bright light on the silver part, the special patterns or characters are appeared. Also, the face value, the characters, and the structure etc. can be checked out through a convex touch in the intaglio printing parts.

In case of the fluorescent ink, an ultraviolet light and an infrared light are irradiated on the banks by using an ultraviolet fluorescent lamp and an infrared fluorescent lamp, so that the inherent color of the fluorescent material is emitted, thereby discriminating the true currency and the fake currency. Also, in case of the magnetic ink applied to the banks and the securities, it judges the existence of the magnetic properties by means of the magnet, thereby discriminating the true currency and the fake currency.

However, after it makes an exquisite counterfeit using the color output equipment (copy machine or printer), since the anti-forgery techniques such as the silver coin, a partially exposing silver wire, a fluorescent color fiber, an optically variable printing material, an intaglio printing etc. are imitated and faked by means of a transparent ink, a powdered silver ink, an aluminum thin film, and an embossing machine etc., it is hard for the ordinary person to tell with the naked eye that the banks and the securities are counterfeit.

Also, the banks, the securities, and the identification can be faked by the international forgers.

Since the ordinary persons are always exposed to this risk, it is necessary to judge the true or the false of the security products such as the banks, the securities, and the copy pre-

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vention paper. Also, it is difficult for the ordinary person to use the precision machinery used in the bank, since it has problems in terms of a size, a cost, and a management thereof.

Accordingly, the development of a multifunctional counterfeit bill detector for judging the true or the false of various security products regardless of time and place has been required.

Also, in case of a fingerprint detector used in the scene of the crime, since a fingerprint developing liquid is applied or sprayed, the fingerprint is collapsed or disappeared. Accordingly, since it is a quite cumbersome to shine the UV LED light again after the spraying of the fingerprint developing liquid, it is hard to rapidly collect the evidence at the scene of the crime.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior art, and an object of the present invention is to provide a portable latent fingerprint developing apparatus capable of visibly checking out an external shape of a finger print by using an UV LED lamp, after a fine spray of a fingerprint developing liquid is conducted by using a vibrator and providing the corresponding fingerprint image to an external terminal, after it is photographed by a camera.

Another object of the present invention is to provide a portable latent fingerprint developing apparatus in that a fine spray can be conducted without spraying or applying the fingerprint developing liquid and it shines the UV LED light simultaneously with the spraying of the fingerprint developing liquid, so that it can be sprayed in a wide space and the fingerprint image can be directly detected.

Another object of the present invention is to provide a portable latent fingerprint developing apparatus capable of providing convenient portability and storage to users.

In order to accomplish these objects, there is provided a portable latent fingerprint developing apparatus, including: a case; a developing reagent tank for storing a developing liquid therein; a vibrator for vibrating the developing liquid supplied from the developing reagent tank according to a control of a controller and spraying fine droplets through a fine droplet spraying device; the fine droplet spraying device for discharging the fine droplets formed by the vibrator to outside; an UV lamp for irradiating an UV light on an object; and the controller for controlling the vibrator.

Preferably, the UV lamp and the fine droplet spraying device face in the same direction so as to spray the fine droplets of the developing liquid and irradiate the UV light of the UV lamp toward the same area, thereby detecting the fingerprint image simultaneously with the spray thereof.

Preferably, the developing reagent tank includes a separate stopper formed at a rear portion of the case so as to store the fingerprint developing liquid therein and open and close the developing reagent tank.

Preferably, the fine droplet spraying device includes a plurality of small apertures formed at a front portion of the case so as to discharge the fine droplets formed by the vibrator to outside.

Preferably, the UV lamp is formed on the periphery of the fine droplet spraying device at regular intervals and includes a plurality of UV LEDs for irradiating the UV light on the object.

Preferably, the portable latent fingerprint developing apparatus further includes a camera for automatically photographing a fingerprint when the fingerprint is developed on the object and storing a fingerprint image in a memory unit

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according to a control of the controller; and the memory unit for storing the fingerprint image photographed by the camera therein.

Preferably, the portable latent fingerprint developing apparatus further includes a fingerprint image discriminating unit for recognizing and discriminating the fingerprint images so as to obtain the images through the camera continually operated and automatically recognize the fingerprint images, thereby storing the fingerprint images in the memory unit.

Preferably, the portable latent fingerprint developing apparatus further includes an USB port for transmitting the fingerprint image to an external terminal.

Preferably, the portable latent fingerprint developing apparatus further includes a spraying switch for spraying the fine droplet.

Preferably, if the spraying switch is pressed, the UV lamp is simultaneously operated.

In order to accomplish these objects, there is provided a portable latent fingerprint developing apparatus, including: a case; a developing reagent tank formed on a rear portion of the case so as to store a developing liquid therein; a vibrator for vibrating the developing liquid supplied from the developing reagent tank according to a control of a controller and spraying fine droplets through a fine droplet spraying device; the fine droplet spraying device formed on a front of the case so as to discharge the fine droplets formed by the vibrator to outside; an UV lamp formed on the periphery of the fine droplet spraying device at regular intervals so as to irradiate an UV light on an object; a camera for automatically photographing a fingerprint when the fingerprint is developed on the object and storing a fingerprint image in a memory unit according to a control of the controller; the memory unit for storing the fingerprint image photographed by the camera therein; an USB port for transmitting the fingerprint image to an external terminal; a spraying switch for spraying the fine droplet and operating the UV lamp; and the controller for controlling the vibrator, the fine droplet spraying device, the UV lamp, the camera, the memory unit, the USB port, and the spraying switch.

Preferably, the UV lamp is electrically connected to the camera.

Preferably, the portable latent fingerprint developing apparatus, further includes a power supplying unit formed on one side of the rear portion thereof so as to supply a power thereto.

Preferably, during operating of the spraying switch, the controller obtains the corresponding signal and transmits the operation signal to the fine droplet spraying device and the UV lamp so as to irradiate the UV light on the object simultaneously with the spray thereof and then, an operation signal is transmitted to the camera by means of the controller, thereby photographing the fingerprint image, when the fingerprint on the object is recognized.

Preferably, at least one UV lamp includes a plurality of short wavelength lamps for generating a short wavelength wave and a plurality of long wavelength lamps for generating a long wavelength wave.

Preferably, the portable latent fingerprint developing apparatus further includes a camera switch for operating the camera.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

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FIG. 1 is a block diagram illustrating a portable latent fingerprint developing apparatus according to one embodiment of the present invention;

FIG. 2 is an example view illustrating a status of checking out a latent fingerprint with the naked eye during the operation of a UV lamp simultaneously with a spray by using a portable latent fingerprint developing apparatus according to one embodiment of the present invention;

FIG. 3 is a perspective view illustrating a front portion of a portable latent fingerprint developing apparatus according to one embodiment of the present invention;

FIG. 4 is an example view illustrating a fingerprint developing effect for comparing a portable latent fingerprint developing apparatus according to one embodiment of the present invention with a conventional art;

FIG. 5 is another perspective view illustrating a front portion of a portable latent fingerprint developing apparatus according to one embodiment of the present invention;

FIG. 6 is an enlarged perspective view illustrating a fine droplet spraying device and an UV lamp of a portable latent fingerprint developing apparatus according to one embodiment of the present invention;

FIG. 7 and FIG. 8 are perspective views illustrating a rear portion of a portable latent fingerprint developing apparatus according to one embodiment of the present invention; and

FIG. 9 is a perspective view illustrating a portable latent fingerprint developing apparatus according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, an exemplary embodiment of the present invention will be described in detail with reference to the accompanying drawings.

FIG. 1 is a block diagram illustrating a portable latent fingerprint developing apparatus according to one embodiment of the present invention, FIG. 2 is an example view illustrating a status of checking out a latent fingerprint with the naked eye during the operation of a UV lamp simultaneously with a spray by using a portable latent fingerprint developing apparatus according to one embodiment of the present invention, FIG. 3 is a perspective view illustrating a front portion of a portable latent fingerprint developing apparatus according to one embodiment of the present invention, FIG. 4 is an example view illustrating a fingerprint developing effect for comparing a portable latent fingerprint developing apparatus according to one embodiment of the present invention with a conventional art, FIG. 5 is another perspective view illustrating a front portion of a portable latent fingerprint developing apparatus according to one embodiment of the present invention, FIG. 6 is an enlarged perspective view illustrating a fine droplet spraying device and an UV lamp of a portable latent fingerprint developing apparatus according to one embodiment of the present invention, and FIG. 7 and FIG. 8 are perspective views illustrating a rear portion of a portable latent fingerprint developing apparatus according to one embodiment of the present invention.

As shown in FIG. 1, the portable latent fingerprint developing apparatus according to one embodiment of the present invention includes:

a case **100**;

a developing reagent tank **600** formed on a rear portion of the case **100** so as to store a developing liquid therein;

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a vibrator **810** for vibrating the developing liquid supplied from the developing reagent tank **600** according to a control of a controller **820** and spraying fine droplets through a fine droplet spraying device **300**;

the fine droplet spraying device **300** formed on a front of the case **100** so as to discharge the fine droplets formed by the vibrator **810** to outside;

an UV lamp **200** formed on the periphery of the fine droplet spraying device **300** at regular intervals so as to irradiate an UV light on an object;

a camera **700** for automatically photographing a fingerprint when the fingerprint is developed on the object and storing a fingerprint image in a memory unit **830** according to a control of the controller **820**;

the memory unit **830** for storing the fingerprint image photographed by the camera **700** therein;

an USB port **800** for transmitting the fingerprint image to an external terminal **900**; and

the controller **820** for controlling the vibrator **810**, the fine droplet spraying device **300**, the UV lamp **200**, the camera **700**, the memory unit **830**, and the USB port **800**.

The case **100** includes a front portion and a rear portion. A power supplying unit **500** for supplying the power to the developing reagent tank **600** for storing the developing liquid therein is formed on the rear portion thereof. Also, the camera **700**, the UV lamp **200**, and the fine droplet spraying device **300** are formed on the front portion thereof.

The vibrator **810** serves to vibrate the developing liquid, which is supplied from the developing reagent tank **600**, according to the control of the controller, so that the fine droplets are sprayed through the fine droplet spraying device **300**.

The fine droplet spraying device **300** is formed on the front portion of the case **100**. The fine droplet spraying device **300** serves to discharge the fine droplets formed by the vibrator **810** to outside. That is, the fine droplet spraying device **300** serves to evenly spread the fine droplets on the object. Since the construction and techniques of discharging the fine droplets to outside are already well-known in the art, further descriptions on these are omitted here.

Also, the UV lamp **200** is formed on the periphery of the fine droplet spraying device **300** at regular intervals. The UV lamp **200** serves to irradiating the UV light on the object.

In the meantime, the UV lamp **200** includes a plurality of short wavelength lamps for generating a short wavelength wave and a plurality of long wavelength lamps for generating a long wavelength wave, which are properly arranged thereon.

For example, if there are four UV lamps, the UV lamp **200** includes two short wavelength UV lamps and two long wavelength UV lamps.

In the camera **700**, when the fingerprint is developed on the object, it automatically photographs the fingerprint. Thereafter, the fingerprint image is stored in the memory unit **830** according to the control of the controller **820**.

Also, the portable latent fingerprint developing apparatus according to the present invention further includes a camera switch (not shown) for operating the camera **700**.

Since the camera **700** for automatically recognizing and photographing the fingerprint is already well-known in the art, a further description on this is omitted here.

In the memory unit **830**, the fingerprint image photographed by the camera **700** is stored. Also, the USB port **800** is connected to the external terminal **900** and serves to transmit the fingerprint image to the external terminal **900**.

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Also, the controller **820** serves to control the vibrator **810**, the fine droplet spraying device **300**, the UV lamp **200**, the camera **700**, the memory unit **830**, and the USB port **800**.

According to an additional aspect of the present invention, the portable latent fingerprint developing apparatus according to one embodiment of the present invention further includes a spraying switch **400** for spraying the fine droplet and operating the UV lamp **200**.

The spraying switch **400** includes one control button for spraying the fine droplet and another control button for operating the UV lamp **200**. However, in case of only one control button, if it gives the button one press, the fine droplets are sprayed, meanwhile, if it gives the button another press, the UV lamp **200** can be operated.

For example, if the operator gives the spraying switch **400** one press, the controller **820** obtains the corresponding signal and transmits the operation signal to the vibrator **810**. At this time, the developing liquid is vibrated through the vibrator **810** and then the fine droplets are sprayed through the fine droplet spraying device **300**.

Simultaneously with the spray, the operation signal is transmitted to the UV lamp **200** by means of the controller **820**, so that the UV lamp **200** is turned on.

Here, when the fingerprint is recognized, the operation signal is transmitted to the camera **700** by means of the controller **820**, so that it can photograph the fingerprint image.

That is, the UV light is irradiated on the object simultaneously with the spray at the scene of the crime, so that the fingerprint can be seen with the naked eye. Simultaneously, it photographs the fingerprint image and the corresponding image is stored in the memory unit **830**.

In addition, since the latent fingerprint is directly photographed by the camera **700**, the latent fingerprint images can be stored in real time without a separate manipulation.

Here, the UV lamp **200** should be electrically connected to the camera **700**. Since the method of the power supply is already well-known in the art, a further description on this is omitted here.

In the meantime, as shown in FIG. 4, there are a manner using the general sprayer and a manner of irradiating the UV lamp in the conventional fingerprint recognition technology. However, in the present invention, since the UV light is irradiated on the object simultaneously with the spray, the present invention is superior to the conventional art in terms of the effect of the fingerprint developing.

The UV lamp **200** and the fine droplet spraying device **300** face in the same direction so as to spray the fine droplets of the developing liquid and irradiate the UV light of the UV lamp toward the same area, thereby detecting the fingerprint image simultaneously with the spray thereof.

The developing reagent tank **600** includes a separate stopper for storing the fingerprint developing liquid therein and opening and closing the developing reagent tank **600**.

The fine droplet spraying device **300** includes a plurality of small apertures for discharging the fine droplets formed by the vibrator **810** to outside.

Also, the UV lamp **200** is formed on the periphery of the fine droplet spraying device **300** at regular intervals and includes a plurality of UV LEDs for irradiating the UV light on the object.

In the meantime, according to an additional aspect of the present invention, the portable latent fingerprint developing apparatus according to one embodiment of the present invention further includes a fingerprint image discriminating unit for recognizing and discriminating the fingerprint images so as to obtain the images through the camera **700** continually

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operated and automatically recognize the fingerprint images, thereby storing the fingerprint images in the memory unit **830**.

Also, in the present invention, if the spraying switch **400** is pressed, the UV lamp **200** is operated simultaneously with the spray thereof.

FIG. 9 is a perspective view illustrating a portable latent fingerprint developing apparatus according to another embodiment of the present invention.

As shown in FIG. 9, the portable latent fingerprint developing apparatus according to another embodiment of the present invention is a gun type portable latent fingerprint developing apparatus.

That is, the portable latent fingerprint developing apparatus according to another embodiment of the present invention includes:

an ultrasonic vibrator **1000** for vibrating a developing liquid supplied from a developing reagent tank **1300** and spraying fine droplets;

an UV lamp **1100** for irradiating an UV light on an object a small motor **1200** for operating a fan (not shown) during spraying thereof formed on an upper portion of the UV lamp **1100**;

the developing reagent tank **1300** formed at a center of a case;

a PCB 24 PIN connector **1400** formed at an inside of a lower grip;

a lithium ion battery **1500** formed at an upper end of the PCB 24 PIN connector **1400**; and

a rechargeable 24 PIN connection port **1600** for charging the lithium ion battery **1500** formed at a lower end of the case.

That is, the ultrasonic vibrator **1000** is formed at the front portion thereof, the UV lamp **1100** is formed at the upper portion thereof, and the small motor **1200** for operating the fan (not shown) is formed on the uppermost portion thereof.

Also, the developing reagent tank **1300** is formed at the center of the body case, the PCB 24 PIN connector **1400** is formed at the inside of the lower grip, and the lithium ion battery **1500** is formed at the upper end of the PCB 24 PIN connector **1400**.

In the meantime, the rechargeable 24 PIN connection port **1600** is formed at the lower end of the body case, so that the lithium ion battery **1500** can be charged as necessary.

As described above, the portable latent fingerprint developing apparatus according to the present invention may be a cellular phone type portable latent fingerprint developing apparatus or a gun type portable latent fingerprint developing apparatus.

In case of the latent fingerprint developing liquid, a talc, a mica, and a silica etc. can be utilized as the extender filler.

Also, compressive type powders such as a white color powder of a titanium oxide, a barium sulfate, and a calcium carbonate and a black color power of carbon black, graphite, and a molybdenum disulfide etc. can be utilized as the color pigment.

As described above, the portable latent fingerprint developing apparatus according to the present invention can visibly check out an external shape of a finger print by using an UV LED lamp, after a fine spray of a fingerprint developing liquid is conducted by using a vibrator and provide the corresponding fingerprint image to an external terminal, after it is photographed by a camera.

Also, the fine spray can be conducted without spraying or applying the fingerprint developing liquid and it shines the UV LED light simultaneously with the spraying of the fingerprint developing liquid, so that it can be sprayed in a wide space and the fingerprint image can be directly detected.

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Moreover, the portable latent fingerprint developing apparatus can provide the convenient portability and storage to users.

Although a preferred embodiment of the present invention has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A portable latent fingerprint developing apparatus, comprising:

a case;

a developing reagent tank disposed inside the case for storing a developing liquid therein;

a vibrator vibrating the developing liquid supplied from the developing reagent tank to form fine droplets according to a control of a controller;

a fine droplet spraying device disposed in a front side of the case and including a plurality of small apertures for discharging the fine droplets formed by the vibrator toward an object bearing a fingerprint;

an UV lamp including a plurality of UV LEDs for irradiating an UV light on the object, the plurality of UV LEDs being disposed spaced at uniform intervals on the periphery of the fine droplet spraying device; and

a camera disposed in the front side of the case for photographing the fingerprint when the fingerprint is developed on the object; and

the controller for controlling the portable latent fingerprint developing apparatus.

2. The portable latent fingerprint developing apparatus as claimed in claim 1, wherein the UV lamp and the fine droplet spraying device face in the same direction so as to spray the fine droplets of the developing liquid and irradiate the UV light of the UV lamp toward the same area, thereby detecting the fingerprint image simultaneously with the spray thereof.

3. The portable latent fingerprint developing apparatus as claimed in claim 1, wherein the developing reagent tank comprises a separate stopper formed at a rear portion of the case so as to store the fingerprint developing liquid therein and open and close the developing reagent tank.

4. The portable latent fingerprint developing apparatus as claimed in claim 1, further comprising: and a memory unit for storing the fingerprint image photographed by the camera therein.

5. The portable latent fingerprint developing apparatus as claimed in claim 4, further comprising a fingerprint image discriminating unit for recognizing and discriminating the fingerprint images so as to obtain the images through the camera continually operated and automatically recognize the fingerprint images, thereby storing the fingerprint images in the memory unit.

6. The portable latent fingerprint developing apparatus as claimed in claim 1, further comprising an USB port for transmitting the fingerprint image to an external terminal.

7. The portable latent fingerprint developing apparatus as claimed in claim 1, further comprising a spraying switch for spraying the fine droplet.

8. The portable latent fingerprint developing apparatus as claimed in claim 7, wherein the spraying switch is configured such that when pressed, the UV lamp is simultaneously operated therewith.

9. The portable latent fingerprint developing apparatus as claimed in claim 1, wherein the UV lamp is electrically connected to the camera.

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10. The portable latent fingerprint developing apparatus as claimed in claim **1**, further comprising: a power supplying unit formed on one side of a rear portion thereof so as to supply a power thereto.

11. The portable latent fingerprint developing apparatus as claimed in claim **1**, wherein the UV lamp comprises a plurality of short wavelength lamps for generating a short wavelength wave and a plurality of long wavelength lamps for generating a long wavelength wave.

12. A portable latent fingerprint developing apparatus, comprising:

- a case;
- a developing reagent tank disposed inside the case so as to store a developing liquid therein;
- a vibrator vibrating the developing liquid supplied from the developing reagent tank to form fine droplets according to a control of a controller;
- a fine droplet spraying device formed on a front side of the case and including a plurality of small apertures so as to discharge the fine droplets formed by the vibrator toward an object bearing a fingerprint;
- an UV lamp including a plurality of UV LEDs formed spaced at uniform intervals on the periphery of the fine droplet spraying device so as to irradiate an UV light on the object;
- a camera disposed in the front side of the case for automatically photographing the fingerprint when the fingerprint is developed on the object;

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a memory unit for storing the fingerprint image photographed by the camera therein;

an USB port for transmitting the fingerprint image to an external terminal;

a spraying switch for spraying the fine droplet and operating the UV lamp; and

the controller for controlling the vibrator, the fine droplet spraying device, the UV lamp, the camera, the memory unit, the USB port, and the spraying switch.

13. The portable latent fingerprint developing apparatus as claimed in claim **12**, further comprising: a camera switch for operating the camera.

14. The portable latent fingerprint developing apparatus as claimed in claim **12**, wherein the UV lamp is electrically connected to the camera.

15. The portable latent fingerprint developing apparatus as claimed in claim **12**, further comprising: a power supplying unit formed on one side of a rear portion thereof so as to supply a power thereto.

16. The portable latent fingerprint developing apparatus as claimed in claim **12**, wherein the UV lamp comprises a plurality of short wavelength lamps for generating a short wavelength wave and a plurality of long wavelength lamps for generating a long wavelength wave.

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